Remarks

The Official Action mailed April 24, 2009 has been carefully considered. Reconsideration and allowance of the subject application, as amended, are respectfully requested.

Claims 1, 4-7, 9-11, 14-23 and 25-28 remain pending in the application. Claim 16 has been cancelled.

Claims 1 and 25-28 have been amended to emphasize that "said supporting surface of said sealing ring is in flat area contact with said supporting flank of said groove in any expansion or compression state of the sealing ring due to pressure changes of said fluid medium". Support may be found in claim 16 and at paragraph [**0049**] of the published U.S. application which recites "[I]n this context, supporting surface **7** of the sealing ring is in flat contact, more precisely full contact, with supporting flank **11** of the groove. In this context, both surfaces are in flat contact, more precisely full contact, with each other in installed position between components **4** and **6** in every possible expansion/compression condition of the sealing ring." Accordingly, no new matter has been entered.

Claims 1 and 25- 28 have also been amended to recite "wherein a second gap width is provided, at least between said pressurizing surface of the sealing ring and said pressure-side flank, into which said fluid medium to be provided on the pressure side of said sealing ring can flow, pressing said sealing ring in sealing fashion against said supporting flank of said groove and against one of said two components, and, by application of pressure by said fluid medium, said supporting surface of said sealing ring over the height and circumference of the sealing ring is brought into *flat area contact* with said supporting flank of said groove". Support may be found at paragraph [**0012**] which recites "[T]he respective lateral supporting and/or pressurizing surfaces each surround the sealing ring over its entire circumference" and paragraph [**0054**] which recites "[T]hus, gap **10** and, consequently, pressurizing surface **8** of the sealing ring extend over the height of the triangular cross-section of the sealing ring." Accordingly, no new matter has been entered.

Claims 1 and 25-28 have also been amended to recite that the sealing ring is radially compressed outwards towards a radially internal sealing surface, or radially

compressed inwards towards a radially external sealing surface. Support may be found at paragraphs [**0057**] and [**0059**] which respectively recite "[D]ue to the fluid medium flowing into the gap, the sealing ring is pressed radially outwards and expanded slightly." and "[A]s a result of fluid medium flowing into gap **10**, sealing ring 1 is pressed radially inwards, undergoing slight compression, onto component **6** designed as a shaft." Accordingly, no new matter has been added.

Claims 1 and 25-28 have been amended to recite that the "sealing surface (that) can be brought into flat area contact with at least one of said components to form a seal". Support may be found at paragraph [**0049**] which recites "[I]n this context, both surfaces are in flat contact, more precisely full contact, with each other in installed position between components **4** and **6** in every possible expansion/compression condition of the sealing ring." No new matter has been added.

Claim 27 has been further amended to recite that the groove has a base and "said supporting surface forms a lateral surface and said lateral surface extends from said base of said groove up to the area of said sealing ring projecting from said groove and into said first gap width between said components, wherein said lateral surface is in flat area contact with said supporting flank of said groove when the sealing ring is pressurized when said sealing surface of said sealing ring is in flat area contact with said component". Support may be found at paragraph [**0055**] which recites "[A]ccordingly, groove **5** displays an arched groove base **32**. In this context, gap **10** tapers towards groove base **32**. As a result of the extension of gap **10**, into which pressurized fluid medium can flow from the pressure side (on the right in **FIG. 3**), the sealing ring is additionally pressed radially outwards against component **6**, forming a seal." Also see paragraph [**0012**] which recites "[T]he pressurizing surface and/or the supporting surface are preferably each designed at least partly, or completely, as the lateral surface of a truncated cone, this resulting in flat contact with the respective supporting flank or pressure-side flank of the groove at all times, also upon radial expansion/compression of the sealing ring. The respective lateral supporting and/or pressurizing surfaces each surround the sealing ring over its entire circumference." Accordingly, no new matter has been entered.

Claim 28 has been further amended to recite "where the cross-sectional contour of the supporting flank of the groove corresponds to the cross-sectional contour of said

supporting surface of said sealing ring when said sealing surface of said sealing ring is in flat area sealing contact with said sealing surface of said component". Support may be found at paragraph [**0022**] which recites "[T]he cross-sectional contour of the supporting flank of the groove preferably corresponds to the cross-sectional contour of the corresponding supporting surface of the sealing ring, such that the supporting surface and the supporting flank can be brought into contact with each other over part or the whole of their surface in the respective sealing arrangement, particularly at maximum expansion or compression of the sealing ring in the direction of the sealing surface, particularly in all states of expansion or compression. The supporting surface of the sealing ring can preferably be brought into contact with the supporting flank of the groove without any gap." Accordingly, no new matter has been entered.

Claim 28 has also been amended to recite "wherein said component accommodating said sealing ring in said groove is a shaft, in that a shaft guide is provided, with which said sealing surface of said sealing ring is brought into contact in sealing fashion by application of the pressure of said fluid medium during rotary motion of said shaft and said shaft guide relative to each other, in that said shaft guide is made of a light metal, and in that said supporting surface of said sealing ring is inclined to said longitudinal axis of said sealing ring such that, owing to the pressure force of said sealing medium on said sealing ring, said sealing ring is located in non-rotating fashion relative to said shaft guide." Support may be found in original claim 20 and in paragraph [**0057**]. No new matter has been entered.

Claims 7, 26 and 27 have been amended to correct the informalities referenced on pages 2-3 of the Office Action. No new matter has been entered.

Claims 1 and 25-28 have been amended to remove the references to "minus the area…." to overcome the 35 U.S.C. § 112, second paragraph, rejection on page 3 of the Office Action.

As noted above, independent claims 1 and 25-28 have been amended herein to include distinguishing features over the cited art of Abiko and/or Reiners. These distinguishing features include flat area contact of the supporting surface **7** to the supporting flank **11** of the groove **5** and of the sealing surface **2** of the sealing ring to the

other **6** of the two components (see **FIG. 1a**) in any expansion/compression condition of the sealing ring.

The primary reference, Abiko, discloses linear or point sealing as the groove and the seal are not similarly shaped (**FIGS. 2, 4** and **9a**) and accordingly flat area contact is not possible. **FIG. 7** of Abiko appears to disclose a square seal in a square groove but does not disclose a "sealing ring having a generally triangular or trapezoidal cross-section" as recited in amended independent claims 1 and 25-28.

The secondary reference of Reiners discloses a ring **27** which does not maintain flat area contact with the lower side **26** of the groove **17** (see **FIGS. 2** and **4** at **26** and column 3 lines 31-35) and/or flat area contact with the cylinder wall **33** (see FIGS. **3** and **5** at **28**).

Further, neither Abiko nor Reiners disclose a sealing ring configuration wherein the supporting surface of the sealing ring as well as the supporting flank of the groove have an inclination angle of 30° to 60° towards said sealing surface. Abiko discloses only square grooves, and Reiners discloses an angle for both surfaces of significantly greater than 30°.

Claim 28 now recites that "the cross-sectional contour of the supporting flank of the groove corresponds to the cross-sectional contour of said supporting surface of said sealing ring when said sealing surface of said sealing ring is in flat area sealing contact with said sealing surface of said component". This allows for flat area sealing even if the ring is not pressurized. Again this is clearly not the case with the cited references.

Such a sealing arrangement as claimed herein allows for flat area contact of the supporting surface of the sealing ring to the supporting flank of the groove and of the sealing surface of the sealing ring to the sealing surface of the ungrooved component. The cited art is absent such feature.

The Examiner has rejected claims 1, 4-7, 9, 11, 14-23 and 25-28 under 35 U.S.C. 103(a) as being unpatentable over Abiko (WIPO Pub. No. WO01/84024 A1) in view of Reiners (USP 3,104,594).

Abiko, particularly in **FIG. 9** as specifically referenced by the Examiner, discloses a taper portion of the seal ring that is brought into *linear* contact with the *corner* of the side wall of the groove, which, due to the different shapes of the ring and groove,

cannot provide flat area contact between the ring and groove along those surfaces. Column 8 lines 1-3 recite "[a] second seal portion for sealing a side surface of an annular groove of the other member by coming into *linear contact* therewith for sealing an annular gap between said two members".

Reiners discloses a ring that doesn't compress and that *twists* when loaded and heated such that it does not provide flat area contact with the sealing surface and supporting surface (see gaps at **26** and **28** in **FIGS. 2** and **4** and **3** an **5**, respectively). Stated another way, Reiners recites at column 4 lines 39-41 "[t]he angle of inclination of the ring *being more than* the angle of inclination of the groove when the piston is cold" and at lines 46-48 "[t]he ring (is) inclined to the wall of said cylinder so that said wall is engaged by said face *only along the lower edge thereof*".

More specifically, regarding the Examiner's observation on page 21 of the Office Action that "seal element **27** of Reiners is clearly in flat contact with element **33** whether or not there is a pressure," attention is directed to **FIGS. 3** and **5** of Reiners. These **FIGS.** both show a condition where the seal element **27** is **not** in flat contact with cylinder wall **33** (at reference numeral **28**) due to the twisting of the seal. Further, as noted in column 3 lines 26-54, when the piston is cold and not subjected to gas loading "the lower side **32** of the ring **27** being in contact with the lower side **26** of the groove **17** only at the outer edge **34**", see **FIG. 2**. (Emphasis added.) When the piston is cold and subjected to gas loading, "the face **28** of the ring thus contacts the cylinder wall **33** (only) at its lower edge, indicated at **36,** in the manner of a taper face ring".

Further, claim 28 has now been amended to recite that the sealing ring is located in non-rotating fashion relative to the shaft guide. Abiko is silent regarding this feature and Reiners is not directed at a rotating shaft and shaft guide.

Accordingly, it is submitted that Abiko or Reiners, taken alone or in combination, do not support a rejection under 35 U.S.C. §103 of claims 1, 4-7, 9, 11, 14-23 and 25-28, as amended herein.

Claims 4-7, 9-15 and 17-23 depend directly or indirectly from amended claim 1 and are believed to be similarly distinguished.

Claim 10 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Abiko (WIPO Pub. No. WO01/84024 A1), in view of Reiners (USP 3,104,594) and

further in view of Flick (US 2,970,871). Flick appears to disclose ring materials made of rubber, PTFE, etc. but does not make up for the deficiencies of Abiko and Reiners noted above.

Claim 21 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Abiko (WIPO Pub. No. WO01/84024 A1), in view of Reiners (USP 3,104,594) and further in view of Freudenthal (US 4,618,154). Freudenthal appears to disclose an annular lip type sealing apparatus that may be positioned around a member, but does not make up for the deficiencies of Abiko and Reiners noted above.

Some of the unexpected results of the present sealing arrangement include

(a) centering of the sealing ring in the respective receiving groove by means of the pressurizing force of the fluid medium,

(b) a substantially larger contact area between the triangular/trapezoidal sealing ring and the shaft and a substantially longer flow path for leaks compared to a rectangular ring with the same groove depth,

(c) an increase in pressurizing force of the sealing surface of the ring against the corresponding component due to the inclination of the supporting surface (an angle of 30-60°, preferably 45°, provides the best *balance* of pressure from the ring against the sealing surface **2** and the supporting flank **11** (see **FIG. 1**) to allow *simultaneous* flat area contact of the ring). This is particularly true when the contours of the ring and groove correspond as recited in claim 28.

(d) the higher pressurizing force reduces relative rotation of the ring to the component resulting in less wear, reduced fatigue, improved retention of elastic properties and longer life of the ring.

(e) elimination of the need to provide a plurality of sealing rings to prevent leakage, as the single ring arrangement according to the present disclosure provides a larger area of flat surface contact and higher sealing forces, particularly when compared to the cited art.

Having dealt with all the objections raised by the Examiner, it is respectfully submitted that the present application, as amended, is in condition for allowance. Thus, early allowance is earnestly solicited.

If the Examiner desires personal contact for further disposition of this case, the Examiner is invited to call the undersigned Attorney at 603.668.6560.

In the event there are any fees due, please charge them to our Deposit Account No. 50-2121.

Respectfully submitted,

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